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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,666	09/14/2000	Jianmin Qiao	5298-04100/PM00012	9202

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EXAMINER	
PHAM, THANHHA S	

ART UNIT	PAPER NUMBER
2813	5

DATE MAILED: 04/26/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	09/661,666	QIAO ET AL.	
	Examiner	Art Unit	
	Thanhha Pham	2813	

-- The MAILING DATE f this communication appears on the cover sheet with the corresp ndence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 January 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 7-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 5 and 15-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 5, it is not clear where "a gate structure" is located – above or under or on vertical sides of the dielectric layer? -- above or under or on vertical sides of the semiconductor topography?

With respect to claim 15, it is not clear where a gate structure and a semiconductor layer comprising isolation regions are actually located with respect to the semiconductor topography and the dielectric layer – above, under or on vertical sides?

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

1. Claims 1-3, 8 and 10-11 rejected under 35 U.S.C. 102(b) as being anticipated by Yanagida [US 5,314,575].

Yanagida, figs 1-6 and col 1-10, discloses the claimed method for forming a semiconductor device comprising steps of:

etching a first portion of a dielectric layer (1,fig 1B) formed on a semiconductor topography with a first etch chemistry, wherein the first etch chemistry is free of hydrogen and comprises C4F8 (col 2 lines 64-68 and col 3 lines 1-25 &33-40), wherein said dielectric layer is substantially continuous and an interface does not exist between the first portion of the dielectric layer and the second portion of the dielectric layer; and

etching the second portion of the dielectric layer with a second etch chemistry different from the first etch chemistry, wherein said second etch chemistry comprises CHF3 (col 3 lines 26-32).

2. Claims 1-4, 7-8, 10-12, 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Bothra [US 6,080,661].

Bothra, figs 2-11, discloses the claimed method for forming a semiconductor device comprising steps of:

etching a first portion of a dielectric layer (216, fig 7) formed on a semiconductor topography with a first etch chemistry, wherein the first etch chemistry is free of hydrogen and comprises C4F8 and CO (col 8 lines 27-59 and table B), wherein said dielectric layer is substantially continuous and an interface does not exist between the first portion of the dielectric layer and the second portion of the dielectric layer; and

etching the second portion of the dielectric layer with a second etch chemistry different from the first etch chemistry, wherein said second etch chemistry comprises CHF3 (col 9 lines 16-26 and table A).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-5 and 7-8, 10-22 and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko [US 6,337,285] in view of Yanagida [US 5,314,575].

Ko, figs 3-5 and col 1-7, discloses a method for forming a self-aligned contact in a semiconductor device comprising steps:

depositing a substantially continuous dielectric layer (24, doped oxide, fig 3) upon first and second gate laterally spaced gate structures on a semiconductor layer comprising isolation region (undoped oxide, col 4 lines 40-52, col 2 lines 45-49);

etching a first portion of the substantially continuous dielectric layer with a first etch chemistry comprising C4F8 and CO sufficiently to expose a sidewall spacer of said gate structure (see fig 4, col 5 lines 62-67 and col 4 lines 1-22); and

etching a second portion of the substantially continuous dielectric layer with a second etch chemistry comprising a hydrofluorocarbon etchant including CHF3 sufficiently to expose a substrate/the semiconductor layer under said substantially continuous dielectric layer, wherein the thickness of the second portion of the substantially continuous dielectric layer is greater than approximately one half of a height of the first and second gate laterally spaced gate structures (see fig 5 and col 6 lines 34-62).

Ko fails to teach that said first etch chemistry is substantially free of hydrogen.

Yanagida teaches etching the substantially continuous dielectric layer using a two-step etching wherein the first step of etching using the first etch chemistry substantially free hydrogen to etch the first portion of the substantially continuous dielectric layer with a high rate of etching.

It would have been obvious for those skilled in the art to combine the teaching of Yangida to the process of Ko to use the first etch chemistry substantially free hydrogen as being claimed to etch the first portion of the substantially continuous dielectric layer to form the self-aligned contact hole in a semiconductor device with low production cost (high production speed).

With respect to claims 4-5, 12-14, 18-19, 25-26 ranges of thicknesses of the first and second portions of the substantially continuous dielectric layer, ranges of relative

etch selectivity, range of dopant concentration of phosphorous in the substantially continuous dielectric layer are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious.

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
>
> *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

4. Claims 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko [US 6,337,285] and Yanagida [US 5,314,474] as applied to claim 1 or 17 above, in further view of Ko et al [US 6,117,791].

Ko ('285) in view of Yanagida substantially discloses the claimed method comprising steps of etching the substantially continuous dielectric layer of doped silicon oxide using the first etch chemistry and the second etch chemistry except teaching the second etch chemistry comprising C2H2F4

However, C2H2F4 is a well-known etchant material to dielectric materials. C2H2F4 is a well-known material which has been used to improve eching selectivity while etching a dielectric layer. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co., Inc. v. Interchemical Corp. , 325 U.S. 327, 65 USPQ 297 (1945).

Moreover, Ko ('791) teaches that C2H2F4 is an improved etchant to etch a dielectric layer of doped silicon oxide selectively to both undoped silicon oxide and silicon nitride. It would have been obvious for those skilled in the art to apply the teaching of Ko ('791) to use the second etch chemistry comprising C2H2F4 in the process of Ko ('285) and Yanagida to form an improved self-aligned contact with a better-control-etching process to make a better device.

5. Claims 1-5 and 7-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al [US 6,025,255] in view of Yanagida et al [US 5,314,575].

Chen et al, figs 4's and col 1-6, discloses a method for forming a self-aligned contact in a semiconductor device comprising steps:

depositing a substantially continuous dielectric layer (28, fig 4D) upon first and second gate laterally spaced gate structures on a semiconductor layer comprising isolation region (16);

etching a first portion of the substantially continuous dielectric layer with a first etch chemistry comprising C4F8 sufficiently to expose a sidewall spacer of said gate structure (see fig 4E); and

etching a second portion of the substantially continuous dielectric layer with a second etch chemistry comprising a hydrofluorocarbon etchant including CHF3 sufficiently to expose a substrate/the semiconductor layer under said substantially continuous dielectric layer, wherein the thickness of the second portion of the substantially continuous dielectric layer is greater than approximately one half of a height of the first and second gate laterally spaced gate structures.

Chen et al fails to teach that said first etch chemistry is substantially free of hydrogen.

Yanagida teaches etching the substantially continuous dielectric layer using a two-step etching wherein the first step of etching using the first etch chemistry substantially free hydrogen to etch the first portion of the substantially continuous dielectric layer with a high rate of etching.

It would have been obvious for those skilled in the art to combine the teaching of Yangida to the process of Chen et al to use the first etch chemistry substantially free hydrogen as being claimed to etch the first portion of the substantially continuous dielectric layer to form the self-aligned contact hole in a semiconductor device with low production cost (high production speed).

With respect to claims 4-5, 12-14, 18-19, 25-26 ranges of thicknesses of the first and second portions of the substantially continuous dielectric layer, ranges of relative

etch selectivity, range of dopant concentration of phosphorous in the substantially continuous dielectric layer are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

With respect to claims 7, 9 and 23, CO and C2H2F4 are well-known etchant materials to dielectric materials. CO is an well-known etchant which has been used to improve etching profile while etching a dielectric layer. C2H2F4 is a well-known material which has been used to improve eching selectivity while etching a dielectric layer. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co., Inc. v. Interchemical Corp. , 325 U.S. 327, 65 USPQ 297 (1945) (Claims to a printing ink comprising a solvent having the vapor pressure characteristics of butyl carbitol so that the ink would not dry at room temperature but would dry quickly upon heating were held invalid over a reference teaching a printing ink made with a different solvent that was nonvolatile at room temperature but highly volatile when heated in view of an article which taught the desired boiling point and vapor pressure characteristics of a solvent for printing inks and a catalog teaching the boiling point and vapor pressure characteristics

of butyl carbitol. "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.)

6. Claims 4-5, 7, 9, 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagida [US 5,314,575] or Bothra [US 6,080,661] as applied to claim 1 above.

With respect to claims 4-5 and 12-14, ranges of thicknesses of the first and second portions of the dielectric layer, ranges of relative etch selectivity, range of dopant concentration of phosphorous in the substantially continuous dielectric layer are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

With respect to claims 7 and 9, CO and C2H2F4 are well-known etchant materials to dielectric materials. CO is an well-known etchant which has been used to improve etching profile while etching a dielectric layer. C2H2F4 is a well-known material which has been used to improve eching selectivity while etching a dielectric layer. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co., Inc. v.

Interchemical Corp. , 325 U.S. 327, 65 USPQ 297 (1945). "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." See 65 USPQ at 301.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
April 16, 2002

Tuan H. Nguyen
Primary Examiner